

IN THE CLAIMS

CLEAN COPY

RECEIVED
MAY 15 2003
GROUP 1700

1. (PREVIOUSLY AMENDED) A method of eliminating volcano effect in dual damascene comprising the steps of:

providing a substrate having first and second insulative layers, optionally separated from each other by an intervening etch-stop layer formed thereon said substrate;

forming a hole opening through said first and second insulative layers;

forming a fill material over said substrate, including in said hole opening, wherein said fill material comprises l-line photoresist;

removing any excess fill material over said hole opening, wherein said removing said any excess fill material is accomplished by chemical mechanical polishing or by etching;

forming a trench opening in said second insulative layer over said hole opening in said first insulative layer, thus completing the forming of said dual damascene structure on said substrate;

removing said fill material from said hole opening;

RECEIVED
MAY 15 2003
GROUP 1700

depositing metal in said dual damascene structure; and

removing excess metal to complete the forming of said dual damascene without the volcano effect.

2. The method of claim 1, wherein said substrate is silicon.

3. The method of claim 1, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

4. The method of claim 1, wherein said first insulative layer has a thickness between about 1000 to 10000 Å.

5. The method of claim 1, wherein said optional intervening etch-stop layer is silicon nitride.

6. (CURRENTLY AMENDED) The method of claim 1, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

7. The method of claim 1, wherein said second insulative layer has a thickness between about 1000 to 10000 Å.

8. (CANCELLED)

9. (CURRENTLY AMENDED) A method of eliminating volcano effect in dual damascene comprising the steps of:

providing a substrate having first and second insulative layers, optionally separated from each other by an intervening etch-stop layer formed thereon said substrate;

forming a hole opening through said first and second insulative layers;

forming a fill material over said substrate, including in said hole opening, wherein said fill material comprises spin-on organic oxide;

removing any excess fill material over said hole opening, wherein said removing said any excess fill material is accomplished by chemical mechanical polishing or by etching;

forming a trench opening in said second insulative layer over said hole opening in said first insulative layer, thus completing the forming of said dual damascene structure on said substrate;

removing said fill material from said hole opening;

depositing metal in said dual damascene structure; and

removing excess metal to complete the forming of said dual damascene without the volcano effect.

10. (CANCELLED)

11. The method of claim 1, wherein said metal comprises copper.

12. The method of claim 1, wherein said metal has a thickness between about 1000 to 15000 Å.

13. (PREVIOUSLY AMENDED) The method of claim 1, wherein said removing said excess metal is accomplished by chemical mechanical polishing.

14. (PREVIOUSLY AMENDED) A method of eliminating volcano effect in dual damascene comprising the steps of:

providing a substrate having a passivation layer formed over a first metal layer formed on said substrate;

forming a first insulative layer over said substrate;

forming an optional etch-stop layer over said first insulative layer;

forming a second insulative layer over said etch-stop layer;

forming a first photoresist layer over said second insulative layer and patterning said photoresist to form a first photoresist mask having a hole pattern;

etching said first and second insulative layers, including said optional etch-stop layer through said hole pattern to form a hole reaching said passivation layer;

removing said first photoresist mask;

forming a fill material over said substrate, including in said hole opening, wherein said fill material comprises I-line photoresist;

removing any excess fill material over said hole opening, wherein said removing is accomplished by chemical mechanical polishing;

forming a second photoresist layer over said substrate, including said hole opening and patterning said second photoresist to form a second photoresist mask having a trench pattern;

etching said second insulative layer through said trench pattern in said second photoresist mask to form a trench in said second insulative layer, thus completing the forming of said dual damascene structure in said substrate;

removing said second photoresist mask;

removing said fill material from said hole opening;

depositing a second metal in said dual damascene structure; and

removing excess metal to complete the forming of said dual damascene without the volcano effect.

15. The method of claim 14, wherein said substrate is silicon.

16. The method of claim 14, wherein said first metal is copper.

17. The method of claim 14, wherein said first insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

18. The method of claim 14, wherein said first insulative layer has a thickness between about 1000 to 10000 Å.

19. The method of claim 14, wherein said optional etch-stop layer is silicon nitride.

20. The method of claim 14, wherein said second insulative layer is a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

21. The method of claim 14, wherein said second insulative layer has a thickness between about 1000 to 10000 Å.

22. (CANCELLED)

23.(CURRENTLY AMENDED) A method of eliminating volcano effect in dual damascene comprising the steps of:

C1
providing a substrate having a passivation layer formed over a first metal layer formed on said substrate;

forming a first insulative layer over said substrate;

forming an optional etch-stop layer over said first insulative layer;

forming a second insulative layer over said etch-stop layer;

forming a first photoresist layer over said second insulative layer and patterning said photoresist to form a first photoresist mask having a hole pattern;

etching said first and second insulative layers, including said optional etch-stop layer through said hole pattern to form a hole reaching said passivation layer;

removing said first photoresist mask;

forming a fill material over said substrate, including in said hole opening, wherein said fill material comprises spin-on organic oxide;

removing any excess fill material over said hole opening, wherein said removing is accomplished by chemical mechanical polishing;

forming a second photoresist layer over said substrate, including said hole opening and patterning said second photoresist to form a second photoresist mask having a trench pattern;

etching said second insulative layer through said trench pattern in said second photoresist mask to form a trench in said second insulative layer, thus completing the forming of said dual damascene structure in said substrate;

removing said second photoresist mask;

removing said fill material from said hole opening;

C1 end
depositing a second metal in said dual damascene structure; and

removing excess metal to complete the forming of said dual damascene without the volcano effect.

24. (CANCELLED)

25. The method of claim 14, wherein said second metal comprises copper.

26. The method of claim 14, wherein said second metal has a thickness between about 1000 to 15000 Å.

27. (PREVIOUSLY AMENDED) The method of claim 14, wherein said removing said excess metal is accomplished by chemical mechanical polishing.

C2
28. (NEW) The method of claim 9, wherein said first and said second insulative and layers are a low-k dielectric having a dielectric constant between about 2.2 to 3.5.

29.(NEW) The method of claim 9, wherein said metal comprises copper.

30.(NEW) The method of claim 23, wherein said first and said second
insulative layers are a low-k dielectric having a dielectric constant between about
2.2 to 3.5.

31.(NEW) The method of claim 23, wherein said first metal is copper.

32.(NEW) The method of claim 23, wherein said second metal comprises
copper.

C2 end